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Cyclodextrins as Natural Co-Stabilising Agents in Submicron Emulsions

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Purpose: Development and physicochemical characterisation of eudermic submicron emulsions (SE) based on natural surfactants (lecithin, sucrose stearate) with different cyclodextrins as co-stabilising agents.
Methods: Positively and negatively charged SE are prepared by high pressure homogenisation technique [1]. Particle size and zeta potential are determined by dynamic light scattering. Long-term stability of both blank and drug-loaded formulations with progesterone is monitored over up to six months. Drug content and chemical stability are analysed by HPLC. In vitro skin permeation studies with Franz-type diffusion cells are performed as previously reported [2].
Results: All natural cyclodextrins used (α, β, γ) lead to blank SE with excellent physicochemical properties. Particle sizes vary between 120 and 180 nm according to the formulation. Zeta potential (ZP) values of the negatively charged formulations are around −45mV, indicating good long-term stability. Positively charged formulations with a ZP of about +45 mV are produced by addition of phytosphingosine. Incorporation of progesterone slightly influences particle size and zeta potential. Satisfying skin diffusion rates are achieved and an influence of sucrose stearate can be detected.
Conclusion: These studies demonstrate the feasibility of creating skin-friendly SE stabilised with low amounts of natural surfactants. Cyclodextrins decrease the interfacial tension between oil and water, thereby stabilising the system. Inclusion complexes between the lipophilic cavity of the cyclodextrins and fatty chains of the oil phase are supposedly arranged at the interface region thus forming new surface active molecules. Long-term stability of these formulations is excellent and skin diffusion experiments show that they are suitable for application of drugs on skin. SE with low amounts of surfactant but excellent stability are suitable to meet the challenges of both drug delivery and skin care.